

**Product Plan  
for the  
New Millennium Program  
Earth Observing-1 (NMP/EO-1)  
Ground System Development**

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**Prepared by:** \_\_\_\_\_  
**Daniel J. Mandl**  
**EO-1 Ground System Development Manager**

**Approved by:** \_\_\_\_\_  
**Barbara B. Pfarr**  
**Code 584 Branch Head**

**Approved by:** \_\_\_\_\_  
**Dale Schulz**  
**EO-1 Mission Manager**

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# Section 1. Introduction

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## 1.1 Purpose

This Product Plan (PP) shall be used for the purpose of managing, directing, and reporting on work being performed to develop the EO-1 Ground System (EGS). This plan will detail the organizational structures, responsibilities, and processes used to plan, authorize, and manage all EO-1 Ground System support efforts.

The EGS development team is responsible for systems planning, systems engineering, analysis, design, implementation, integration, testing and sustaining engineering of EGS equipment, software, hardware and security. These activities include configuration control oversight and test planning and coordination. The project also provides the principal technical interface with network customers and development and maintenance of interface and mission operations documentation.

## 1.2 Background

One of the key responsibilities of NASA's Earth Science Office is to ensure the continuity of future Landsat data. The New Millennium Program's (NMP) first Earth Observing flight (EO-1), managed by NASA's Goddard Space Flight Center (GSFC) will validate revolutionary technologies contributing to the reduction in cost and increased capabilities for future land imaging missions.

The EO-1 mission will provide the on-orbit demonstration and validation of several spacecraft technologies to enable NASA's planned transition to smaller and lighter spacecraft in the future. Key technology advances in communications, power, propulsion, and thermal and data storage are also included on the EO-1 mission.

The EO-1 Mission will be launched on a Delta 7320 from Vandenberg Air Force Base in December 1999. The EO-1 will fly in a 705-km circular, Sun-synchronous orbit at a 98.7-degree inclination. This orbit allows EO-1 to match, within one minute, the Landsat-7 orbit and collect identical images for later comparison on the ground.

Three revolutionary land imaging instruments on EO-1 will collect multispectral and hyperspectral scenes over the course of its mission in coordination with the Enhanced Thematic Mapper (ETM+) on Landsat-7. Breakthrough technologies in lightweight materials, high-performance integrated detector arrays and precision spectrometers will be demonstrated in these instruments.

Detailed comparisons of the EO-1 and ETM+ images will be carried out to validate these instruments for follow-on missions.

Once or twice a day, sometimes more, both Landsat-7 and EO-1 will image the same ground areas (scenes). All three of the EO-1 land imaging instruments will view all or subsegments of the Landsat-7 swath. Reflected light from the ground will be imaged onto the focal plane of each instrument. Each of the imaging instruments has unique filtering methods for passing light in only specific spectral bands. Bands are selected to best look for specific surface features or land characteristics based on scientific or commercial applications. For each scene, more than 20 Gbits of scene data from the Advanced Land Imager, Hyperion, and Atmospheric Corrector will be collected and stored on the on-board solid state data recorder at high rates.

When the EO-1 spacecraft is in range of a ground station, the spacecraft will automatically transmit its recorded image to the ground station for temporary storage. The ground station will store the raw data on digital tapes that will be periodically sent via overnight mail delivery to the Goddard Space Flight Center for processing and sent to the EO-1 science and technology teams for validation and research purposes.

### **1.3 Product Plan Review and Update**

This document shall be reviewed by the EO-1 Mission Manager, the EO-1 Mission Systems Engineer, the Code 584 Branch Head, and the EGS Development Manager, as well as other EO-1 subsystems leads. This document shall be approved by the Code 584 Branch Head and the EO-1 Mission Manager. This document has been developed by and shall be maintained by the EGS Development Manager. It may be updated to reflect changes in the project objectives.

## Section 2. Customer Agreement

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This section describes the agreement between the EO-1 Mission Management customer and the EGS Development team, including those issues related to requirements, deliverables, acceptance, maintenance, and transition to operations.

### 2.1 Customer(s) Identification

The primary customer for the products developed by the EGS Development team is the EO-1 Mission Project Office.

### 2.2 Customer Goals and Objectives

The customer's objective with respect to the EGS Development Team is to develop a ground system for the EO-1 mission that will monitor, control, and maintain the health and safety of the EO-1 spacecraft and instruments, and process, archive and distribute telemetry and science data products to the users.

### 2.3 Requirements

The EGS will consist of ground stations; a mission operations center consisting of a core ground system, data processing system, mission operations planning and scheduling system, and flight dynamics system; and ground station network and ground communication. The ground stations shall receive, process, and route science and housekeeping data to the mission operations center at GSFC. The ground station network shall be established to support all phases of the EO-1 mission. The mission operations center at GSFC shall receive and process data sent from the ground stations; maintain an orbit of sufficient precision for scene comparisons; maintain the health and safety of the spacecraft and instruments; validate and calibrate on-board and attitude subsystems; perform orbit maneuver control to enable formation flying with the Landsat-7 spacecraft; and provide mission planning and command management.

Detailed EO-1 ground system requirements are documented in the New Millennium Program Earth Orbiter-1 (EO-1) Detailed Mission Requirements (DMR) and the New Millennium Program Earth Orbiter-1 (EO-1) Ground Segment Level II Requirements documents located at <http://eo1.gsfc.nasa.gov/>.

## **2.4 Deliverables**

The products that will be delivered by the EGS Development team include the EO-1 Mission Operations Center (MOC) consisting of the Core Ground System, Data Processing System, Mission Operations Planning and Scheduling System, and Flight Dynamics System. The EO-1 MOC will be comprised of hardware, commercial off-the-shelf (COTS), government off-the-shelf (GOTS), custom software, and associated facilities and documentation.

## **2.5 Necessary Customer Training**

The customers will be trained in the mission setup procedures, normal operating procedures, and system recovery procedures. The training will be provided at the EO-1 Mission Operations Center at GSFC.

## **2.6 Medium for Product Delivery**

All products consisting of EO-1 MOC hardware, COTS, GOTS, and custom software will be installed and verified by the EGS Development team. All associated documentation will be delivered in electronic format and kept on-line when possible. All products will be delivered in accordance with the GPG 6400.1 procedure (<http://gdms.gsfc.nasa.gov/>).

## **2.7 Product Destination**

All products will be located at the GSFC in Building 14, Room N285.

## **2.8 Post-Delivery Maintenance**

Maintenance of the Core Ground System, Data Processing System, Mission Operations Planning and Scheduling System, and the Flight Dynamics System will be the responsibility of the EGS Development team. Maintenance will include bug fixes, enhancements, and upgrades.

Maintenance activities will be performed using the same process and procedures as utilized in the development activities.

## **2.9 Customer-Supplied Elements, Both Technical and Resources**

This section describes those elements of the EGS development effort that are to be supplied by the customers.



### 2.9.1 Funding

The customer shall provide all funding necessary to complete the EGS Development project. This includes funding for all hardware, software, logistics, personnel, and facility equipment required for the project.

### 2.9.2 Information and Support

The customer shall be the primary point of contact for the development of the concise list of requirements for the EGS. Throughout the development of the EGS, the customer will continue to serve as a point of contact for questions regarding detailed requirements and operations concepts. The customers shall participate in weekly and monthly status reviews and all major reviews as required; review all documentation and provide timely comments; and approve changes in Level I and Level II requirements. The customer shall keep the EGS Development team apprised of any changes in the EO-1 Mission schedule and budget.

### 2.9.3 Test Environment

The customer shall provide the test bed, spacecraft, and instrument test data and the project database (PDB) for verification of the EGS.

## **2.10 Customer Involvement**

This section describes the involvement of the customer personnel that will be required to insure that the product delivered meets the requirements.

### 2.10.1 EO-1 Mission Manager

The EO-1 Mission Manager, Code 426, is responsible for establishing the requirements, schedules, and cost to be met by the EGS. In addition, it is the Mission Manager who has the final authority over the acceptability of the deliverables and will approve of change in scope, acceptability of level of risk, and modification to schedule.

### 2.10.2 EO-1 Mission System Engineer

The EO-1 Mission System Engineer, Code 730, is the primary point of contact for specific technical and interface issues regarding the EO-1 Mission. He provides guidance with respect to the specific technical performance of the EGS against the requirements specified by the EO-1 Mission Manager.

## **2.11 Customer Communications**

Communication with the customer will be carried out in a variety of forms. The EGS Development Manager will meet with the customer on a regular basis to report status (technical, schedule, and cost), bring up development issues, and discuss design decisions. A report describing the project status, action items status, recent accomplishments, near-term plans, and problems encountered will be delivered to the customer at the end of each month.

## **2.12 Authority for Changes**

All changes to the requirements for the project required or requested by the customer or external users should be forwarded to the EGS Development manager electronically. A configuration change request will be initiated using the EO1 Configuration Management On-Line Processing System (COPS) located at <http://hst-nic.hst.nasa.gov:443/eo1a/eo1ncm.htm>. If changes in requirements will result in a change in the EGS development schedule or cost, the customer will be informed of the estimated impact promptly.

## **2.13 Acceptance Criteria**

The EO-1 MOC product development will be completed when the customer accepts it. A complete demonstration of the EGS will be performed during Operational Readiness Testing. This demonstration will exercise all features of the EGS that corresponds to the documented system requirements. An Operational Readiness Review (ORR) will be conducted 60 days prior to the EO-1 spacecraft launch with the customer to ascertain acceptance and operability of the EGS. Acceptance of the EGS will be documented in the minutes of the ORR meeting and concurred by the EO-1 Mission Manager.

## **2.14 Customer Agreement Review and Update Process**

The customer, external users, or the EGS Development Team may initiate changes to the requirements. All changes must be requested using the EO-1 COPS located at <http://hst-nic.hst.nasa.gov:443/eo1a/eo1ncm.htm>. Requested configuration changes will be reviewed and must be approved by both the customer and the EGS Development manager before they are implemented. A database is created to track the requested changes, which is available at the EO-1 web page at <http://hst-nic.hst.nasa.gov:443/eo1a/eo1ncm.htm>. Any changes to cost and/or schedule unrelated to requirements changes will also be submitted to the customer for approval.

## Section 3. Management Approach

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This section describes the management approach that will be employed in the EGS Development effort.

### 3.1 General Development Approach

The general development approach of the EGS will maximize the use of COTS and GOTS products. Specifically, products that have been successfully employed for similar projects will be evaluated and reused for this effort. The development approach will be in accordance with the ISC Product Development Handbook (<http://isc.gsfc.nasa.gov/html/iso-9001.htm>) and the GSFC ISO 9001 Quality Manual (QM) (<http://arioch.gsfc.nasa.gov/iso9000/index.htm>).

### 3.2 Resources Needed

The EGS Development manager will maintain a manpower spreadsheet that will track and project the staffing resources required to develop the ground system. Identification and tracking of resources will be by source (i.e., contractor, civil servant) and subsystems.

### 3.3 Team Organization

This section describes the organization and purpose of the EGS Development team.

#### 3.3.1 Team Organization Chart

The EGS Development team consists of NASA and contractor personnel. A chart showing the overall EO-1 organization can be found at <http://eo1.gsfc.nasa.gov/NUwww/Project/OrgChart/Orgchart.gif>.

#### 3.3.2 Team Charter

The EGS team is chartered to develop a ground system using COTS and GOTS wherever possible to meet the New Millennium Program Earth Orbiter-1 (EO-1) Ground Segment Level II Requirements. The ground system will support integration, prelaunch checkout, launch, early orbit, and on-orbit operations.

### 3.3.3 Team Scope

The team scope is for a period from initial start of ground system development to launch plus 60 days and includes the development, test, integration, and training required to successfully deploy the EGS. The EGS Development team will procure and/or develop and install all hardware and software necessary for the EGS.

### 3.3.4 Roles, Responsibilities, Authority, Accountability

This section describes the roles and responsibilities of the members and supporting organizations associated with the EGS development.

#### 3.3.4.1 EGS Development Manager

The EGS Development manager, Code 584, is responsible for the design, development, testing, and deployment of the hardware and software meeting the requirements of the EGS. The EGS Development manager is responsible for integrating the major ground subsystems into a working EO-1 ground system. In addition, the EGS Development manager will provide documentation of the product, status reports as required, and demonstrations of progress as available. The EGS Development manager also allocates and tracks all ground system development work among team members.

#### 3.3.4.2 EO-1 Ground System Engineer

The EO-1 Ground System Engineer, Code 581, is responsible for the technical integrity of the EGS. The EGS system engineer is responsible for defining the interfaces to the EGS both externally and internally as well as performing the required requirement analysis needed to implement the system.

#### 3.3.4.3 Core Ground System (CGS) Development Manager

The Core Ground System (CGS) Development manager, Code 581, is responsible for the development and integration of the EO-1 CGS. The CGS is responsible for performing command and control, health and safety monitoring, trending, command management and S-band data processing. The CGS Development manager is responsible for integrating the CGS into a working EGS. In addition, CGS Development manager will provide documentation of the product, status reports as required, and demonstrations of progress as available.

#### 3.3.4.4 Flight Dynamics Support System (FDSS) Development Manager

The FDSS Development manager is responsible for the development of the Flight Dynamic System Software, and analysis of attitude, orbit and maneuver planning required for EO-1. The FDSS software is responsible for the attitude and orbit determination required for EO-1. The

FDSS Development manager is responsible for integrating the FDSS into a working EGS. In addition, the FDSS Development manager will provide documentation of the product, status reports as required, and demonstrations of progress as available.

#### 3.3.4.5 Data Processing System (DPS) Development Manager

The Data Processing System (DPS) development Manager, Code 584, is responsible for the development and integration of the EO-1 DPS. The EO-1 DPS is responsible for processing the X-band EO-1 science data and producing the Level 0+ data products. The DPS manager is responsible for integrating the DPS into a working EGS. In addition, the DPS manager will provide documentation of the product, status reports as required, and demonstrations of progress as available.

#### 3.3.4.6 Network and SOMO Services Interface Manager

The Network and SOMO Services Interface manager, Code 453, is EGS's representative to SOMO for network services required by EO-1 from the integrated network services managed by SOMO. The Interface manager is responsible for development and approval of the PSLA defining the support required by EO-1 from the network services.

#### 3.3.4.7 Mission Operations Planning and Scheduling Systems (MOPSS) Development Manager

The MOPSS Development manager, Code 581, is responsible for managing the development and integration of the MOPSS system. The development effort is required for MOPSS to meet new EO-1 requirements. The manager is responsible for integrating the MOPSS into a working EGS. In addition, the MOPSS Development manager will provide documentation of the product, status reports as required, and demonstrations of progress as available.

#### 3.3.4.8 Flight Operations Team Manager

The Flight Operations Team (FOT) Manager, an ATSC contractor position, is responsible for managing the Flight Operations team. The FOT manager is responsible for developing Mission Operations procedures and operational test plan and procedures, conducting operational readiness testing to verify EGS requirements, conducting ORR, operating EGS, and providing status reports as required.

#### 3.3.4.9 Team Members

Besides the managers mentioned in the previous sections, the team is also made up of civil servant and contractor personnel. These team members are assigned to one of the EO-1 MOC subsystems and are managed by one of the subsystem development managers.

### **3.3.5 Decision Making and Conflict Resolution Process**

Requirement conflict will be analyzed by the EGS Development team and EO-1 Mission System Engineer, and conflict resolution recommendation will be approved by the EO-1 Mission Manager. Development issues not affecting mission cost or mission schedule will be resolved by the EGS Development manager. During the launch-plus-60-days phase, the EGS development managers will handle decisions not affecting cost or schedule for the ground system. Issues affecting the mission cost or mission schedule will require the approval of the EO-1 Mission Manager.

### **3.3.6 External Support**

There are four types of external support required by the EGS Development: EO-1 project support; Flight operations team support; SOMO & Network services support; and facilities support. The EO-1 project office support includes funding, Level 1 and 2 requirements, and instrument team interfaces as well as overall integration with other EO-1 project systems (i.e., EO-1 spacecraft, instrument teams). The second type of support, the FOT support, is unique in that during the prelaunch period, the FOT is integrated into the development in order to enhance training and to provide instant feedback to developers. After launch, the FOT reports to the Mission Director. The SOMO interface is described in Section 3.3.3.6. Facilities support is provided by GSFC facility management and includes providing facility space, associated modification, and equipment transportation support.

## **3.4 Team Interfaces**

The EGS development team meets weekly with other EO-1 mission teams and participates in a NMP EO-1 Project Monthly Status Review (MSR). At the MSR, technical, cost, schedule and overall status are assessed. There are also weekly staff, project, and schedule meetings with the NMP EO-1 Project. Internal team interfaces are conducted weekly at two meetings: the ground system development weekly and the ground system test weekly. All subsystems of the ground system participate in these meetings. Schedule, cost, technical status, and issues are discussed at these weekly meetings.

## **3.5 Development Facilities**

The EGS will be developed at Goddard Space Flight Center in Building 14. The contractor team supporting the EO-1 MOC development will use their own facilities and the development facility in Building 14. The development system will be transferred to the EO-1 Mission Operations Center (MOC) in Building 14, Room N285, prior to system integration testing.

### **3.5.1 Modifications of Existing Facilities and Schedules**

No modifications to the facilities will be required for this effort.

### **3.5.2 Development of New Facilities and Schedules**

No new facilities will be required for this effort.

### **3.5.3 Physical Security**

The development facility in Building 14 is secured with keycard access. All government computers are password-protected and on a government-owned network.

## **3.6 Procurement**

This section describes the purchases planned for the project.

### **3.6.1 Procurement Needs and Dates**

The EGS Development manager maintains a hardware and software purchase list that lists, describes, and schedules the ground system procurement needs and dates.

### **3.6.2 Reference Procurement Process**

Purchases of hardware and/or software costing more than \$2,500.00 will be accomplished using the Small Purchases System (SPS). Purchases of hardware and/or software costing less than \$2,500.00 will be accomplished as a credit card purchase by an approved government credit card holder. All purchases will comply with Federal Acquisition Regulations.

## **3.7 Team Training Plan**

No training specific to this project is expected.

## **3.8 Risk Mitigation**

There are a number of risk factors associated with this effort. Management of these risks is the responsibility of the EGS Development manager in conjunction with the other members of the implementation team. The major risk is the schedule. The schedule for delivery of the EGS is aggressive. Mitigation of risk is anticipated by the use of COTS and GOTS software and by the development team's drawing on the experience of EGS personnel. In addition to this process, the EGS development risk process is also integrated into the EO-1 mission risk processes. Any ground system risk that impacts cost or schedule is elevated to the EO-1 mission risk processes. The assessment, mitigation, and monitoring are then handled at this level as well as at the EGS

development level. In addition, the risks identified at the EO-1 mission level are passed to the EGS Development manager for assessment. If they impact the ground system, the mitigation approach is fed back to the EO-1 mission risk process.

### 3.9 Schedule

The EGS development schedule showing the key steps and milestones associated with the development effort is located at <http://eo1.gsfc.nasa.gov/NUwww/images/groundsched.gif>.

### 3.10 List of Controlled Documentation

The following documents related to the EGS development effort are either developed or are in the process of development:

#### Controlled by the EO-1 GSD Project:

- Product Plan for the New Millennium Program Earth Observing-1 (NMP/EO-1) Ground System Development
- Detailed Mission Requirements (DMR) - NMP/EO-1 DMR01
- Test Plan  
<http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/Ground%20Systems/EO1%5FOPS%5FTEST%5FPLAN%5F1%2D15%2D99.DOC>
- ICD's
  - Space to Ground  
([http://hst-nic.hst.nasa.gov:443/eo1/documen~1/LVL\\_II\\_ground\\_req1.pdf](http://hst-nic.hst.nasa.gov:443/eo1/documen~1/LVL_II_ground_req1.pdf))
  - RF ICD
  - MOC to Science Users
- Mission Procedures Document
  - Vol. 1 Concepts  
<http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/Ground%20Systems/EO%2D1%20MPD%20Volume%201%2012%2D4%2D98.doc>
  - Vol. 2 Detailed Ops Plan  
<http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/Ground%20Systems/EO%2D1%20MPD%20Volume%201%2012%2D6%2D98.doc>



Controlled by the EO-1 Mission Project:

- New Millennium Program Earth Orbiter-1 (EO-1) Ground Segment Level II Requirements (<http://eo1.gsfc.nasa.gov>)
- Data Management Plan <http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/DMP/ACF1D5.doc>
- ICD's
  - Landsat MOU
  - GSFC to Lincoln Lab
  - GSFC to TRW
  - GSFC to Stennis MOU
- Launch Site Support Plan

### **3.11 Process for Process and Product Analysis**

The process of the EGS development effort will be analyzed through regular reviews of the schedule, budget, discrepancy reports, CCRs, and status of the subsystem. Peer reviews and project reviews are anticipated. The EO-1 MOC product will be verified during formal testing. A test plan for the effort has been developed and is at

<http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/Ground%20Systems/EO1%5FOPS%5FT%5FPLAN%5F1%2D15%2D99.DOC> .

## Section 4. Technical Approach

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This section describes the technical approach that will be used to develop EGS.

### 4.1 Software Development Plan

The approach to the development of the EGS software will be to maximize the use of COTS and GOTS products. Some legacy systems and/or algorithms will be integrated into the new EO-1 Ground System. Other development may be accomplished using available software development tools.

#### 4.1.1 Major Activities

This section describes the major activities planned in the development of the EGS. Several phases and products of the effort have been identified. For more information, see the EO-1 Ground System Development Schedule, which is included on the EO-1 web page at

<http://eo1.gsfc.nasa.gov/NUwww/images/groundsched.gif>.

##### 4.1.1.1 Phases

The development of the EGS includes the following phases: Requirements, Design, Procurement, Development, Integration and Test, and Installation. The EGS is currently in the integration and test phase. Detailed requirements for all elements of the EGS were gathered during the Requirements phase. The design of the system was developed in the Design phase. Purchase requests for all hardware and software needed to support the EGS development were issued during the Procurement phase. The Development phase includes all EGS-specific software development. During Integration and Test, the EGS will be integrated with other EGS subsystems and tested against the requirements. The Integration and Test phase will be completed when the EGS Operational Test Plan has been implemented and a release form has been signed by the customer and the EGS development team. The Installation phase will be completed when all ground systems are installed at their proper locations, tested, and made ready to support the EO-1 launch. Installation of the EGS system will be the last phase of this effort.

##### 4.1.1.2 Products Associated with Phases

The products associated with the requirements, design, development, and integration and test phases are identified on the EO-1 Ground System Schedule located at

<http://eo1.gsfc.nasa.gov/NUwww/images/groundsched.gif>.

### 4.1.2 Development Methodology

This section describes the methodology that will be employed in the development of this product.

#### 4.1.2.1 Methodology

The ground system will be developed using several different methodologies. The individual subsystems are responsible for defining the methodology that will be used for the development of the subsystem. The subsystem development manager is responsible for ensuring that the methodology is followed. The subsystem will be delivered in several different releases and will be integrated into a consolidated ground system according to the development schedule in order to meet the required capabilities.

The consolidated ground system will be developed using the waterfall methodology. The product will be delivered in several releases. Periodic peer reviews will be conducted to verify the design. An integrated product team (consisting of developers and FOT members) will be used for testing. This test team will verify user interface design.

#### 4.1.2.2 Development Environment

The EO-1 ground system is a distributed system developed and targeted for different machines. The systems are based on the individual subsystems. The following table indicates the subsystem, platform, and languages to be used.

<b>Subsystem</b>	<b>Platform</b>	<b>Language</b>	<b>Methodology</b>
Core Ground System	HP workstation	ASIST, Unix	Modified Waterfall
Data Processing System (DPS)	PC	C	Modified Waterfall
Mission OPS & Planning System (MOPSS)	HP workstation	C, C++, Oracle	Time Box RAD
Flight Dynamics System (FDS)	HP workstation and PC	Matlab, C, Unix, NT	Rapid Application Development

#### 4.1.2.3 Utilized Standards

The EO-1 ground system will use standard DLT tapes for product distribution. The ground system will also receive telemetry and send commands using the CCSDS standard format data unit.

#### 4.1.2.4 Utilized COTS Products and Tools

The EGS Development manager will maintain a spreadsheet tracking all COTS products and tools required.

#### 4.1.2.5 Build Strategy

There are four consolidated releases of the EO-1 ground system planned. The first consolidated release is to support integration testing. Consolidated Release 2 of the ground system will be used to support spacecraft MOC mission readiness test, MOPSS acceptance test, and the S/C-MOC-MOPSS-CMS-FDS I/F MRT. Consolidated Release 3 will be used to support CGS acceptance test, Wallops ground system test, FDS acceptance test, DPS acceptance test, FY2K testing, S/C-MOC-MOPSS-DPS-SVF I/F MRT, RF compatibility MRT, MOC – ground station I/F MRT, and the launch simulation. Consolidated Release 4 is to support the remainder of the testing and EO-1 launch.

#### 4.1.2.6 Product Inspection and Test Approach

Each component submitted or procured for integration into the EGS will be subjected to standard verification and validation procedures to ensure compliance with security and Year 2000 requirements.

All software elements developed specifically for the EGS effort will undergo an internal design, code, and test walkthrough.

Unit testing of each module will be the role of the EGS development team. Modules will be tested against documented EGS requirements.

The consolidated ground system will be tested according to the test plan

<http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/Ground%20Systems/EO1%5FOPS%5FTEST%5FPLAN%5F1%2D15%2D99.DOC>.

This plan describes three levels of testing: subsystem validation testing, mission readiness testing, and simulations. The plan defines test for all three levels. The plan defines a test name, validation requirements, schedule, and test responsibilities for each individual test. All discrepancies found during these tests are placed in the Discrepancy Report database, which is maintained on the EO-1 web site <http://eo1.gsfc.nasa.gov>. If a discrepancy meets the criteria found in the GPG the discrepancy is added to the GSFC NCR System. Traceability is maintained between the GSFC NCR system and the EO-1 discrepancy database.

#### 4.1.2.7 Acceptance Criteria and Objectives

Verification requirements for all tests are provided in the Test Plan

<http://mtpe.gsfc.nasa.gov/eo1/dropbox/docs/Ground%20Systems/EO1%5FOPS%5FT%5FPLAN%5F1%2D15%2D99.DOC>.

#### 4.1.2.8 Reviews Planned

There are five major reviews planned for the EO-1 ground system. They are:

- Spacecraft Critical Design Review (input), 6/25/97
- Ground System System Design Review/Mission Operations Review, 11/6/97
- Mission Delta Critical Design Review, 9/23/98
- Delta Mission Operations Review, 1/28/99
- Flight Operations Review/Operations Readiness Review planned, 11/5/99

#### 4.1.3 Incoming Inspection and Test

The inspection process for new computers, the operating system, and COTS software is installed and perform a simple sanity test. The sanity test just checks to ensure that the applications can be run and that there are no obvious problems.

No inspection other than kind, count, and condition of purchased products is planned for everything else.

#### 4.1.4 Control of Test Equipment

Test equipment for the TDRSS and EO-1 data interfaces will be used in integration and test of the ground system. Control and verification of the test equipment will be the responsibility of the organization providing the test equipment.

### **4.2 Process for Transportation, Identification, and Medium of Product**

Hardware transitions from the development facility to the EO-1 MOC room will make use of the GSFC transportation. Other hardware will be delivered directly to the EO-1 MOC. The EGS development team will install all software in the EO-1 MOC room.

### **4.3 Technology and Commercialization Plan**

The EO-1 mission is a technology demonstration mission. The ground system supports this by providing ground software for enhanced formation flying (EFF), one of the technologies being demonstrated by EO-1. There are no plans for the commercialization of the EO-1 ground system.

### **4.4 Servicing - Process for Product Maintenance**

Servicing of all COTS, hardware and software will be covered under the respective product warranties. Servicing of all GOTS software will be performed by the supplier of that software. Servicing of the custom software will be performed by the EGS development team and its subcontractors. The servicing process will use the same approach as development.

## Section 5. Product Assurance

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This section describes the processes and procedures that will be followed in order to assure that the product developed satisfies the customer's requirements.

### 5.1 Assumptions and Constraints

It is assumed that all GOTS products employed in the EO-1 MOC will be ISO 9001-compliant. The supplier of each GOTS and custom software product is expected to maintain quality records related to the product. It is assumed that all COTS products will meet or exceed all specifications included in the purchase request.

### 5.2 Quality Assurance

This section describes the processes and procedures that will be followed in order to assure that the customer receives a quality product.

#### 5.2.1 Control of Nonconforming Products

The process of controlling nonconforming products will be ISC's ISO-approved team process 7, **Team 7 –Product Nonconformance Process**, which can be found at <http://isc.gsfc.nasa.gov/html/iso9001.htm> under section **ISC ISO 9001 Reference Documentation** in the **Library of Approved Team Processes**.

#### 5.2.2 Corrective and Preventive Action

The process employed for corrective and preventive action will be ISC's ISO-approved team process 8, **Team 8 – Product Nonconformance Prevention Process**, which can be found at <http://isc.gsfc.nasa.gov/html/iso9001.htm> under section **ISC ISO 9001 Reference Documentation** in the **Library of Approved Team Processes**.

#### 5.2.3 Control of Quality Records

The process employed for control of quality records will be ISC's ISO-approved team process 2, **Team 2 – Configuration Control Process**, which can be found at <http://isc.gsfc.nasa.gov/html/iso9001.htm> under section **ISC ISO 9001 Reference Documentation** in the **Library of Approved Team Processes**.

#### 5.2.4 Control of Documents and Data

The process employed for control of documents and data will be ISC's ISO-approved team process 2, **Team 2 – Configuration Control Process**, which can be found at <http://isc.gsfc.nasa.gov/html/iso9001.htm> under section **ISC ISO 9001 Reference Documentation** in the **Library of Approved Team Processes**.

Note: Same process used for control of quality records.

### 5.3 Configuration Management

Configuration management procedures will be applied to all components delivered or developed during this effort. Subsequent builds or deliveries will result in incremental versions of the system. Changes to archived or installed software following the initial delivery will require approval of the EGS Development manager prior to the system being accepted for integration.

#### 5.3.1 Identification and Traceability of Products

The process employed for identification and traceability of products will be ISC's ISO-approved team process 4, **Team 4 – Identification and Traceability of Products Throughout the Lifecycle**, which can be found at <http://isc.gsfc.nasa.gov/html/iso9001.htm> under section **ISC ISO 9001 Reference Documentation** in the **Library of Approved Team Processes**.

#### 5.3.2 Control of Customer-Supplied Elements

The process employed for control of customer supplied elements will be ISC's ISO-approved team process 3, **Team 3 – Control of Products Provided By Customer**, which can be found at <http://isc.gsfc.nasa.gov/html/iso9001.htm> under section **ISC ISO 9001 Reference Documentation** in the **Library of Approved Team Processes**.



## Section 6. Plan Update History

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Version	Date	Description	Affected Pages
1.0	March 1999	Original	All

# Appendix A. Acronyms and Abbreviations

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AGS	Alaska Ground Station [Poker Flat, Alaska]
ASIST	Advanced System for Integration and Spacecraft Test
ATSC	AlliedSignal Technical Services Corporation
CCR	Configuration Change Request
CCSDS	Consultative Committee for Space Data Systems
CDR	critical design review
CGS	Core Ground System
CM	configuration management
COPS	Configuration Management On-Line Processing System
COTS	commercial off-the-shelf
DMP	Data Management Plan
DMR	detailed mission requirements
DPS	Data Processing System
EFF	enhanced formation flying
EGS	EO-1 Ground System
EO-1	Earth Observing-1
FDS	Flight Dynamics System
FDSS	Flight Dynamics Support System
FOT	Flight Operations Team
GDS	ground data system
GOTS	government off-the-shelf [software]
GSFC	Goddard Space Flight Center
I&T	integration and test
ICD	Interface Control Document
ISC	Information Systems Center
ISO	International Organization for Standardization
Landsat	Land Satellite
MOC	Mission Operations Center
MOPSS	Mission Operations Planning and Scheduling Systems
MOR	Mission Operations Review
MOU	memorandum of understanding
MRR	Mission Requirements Review
MSR	monthly status review
NMP	New Millennium Program
ORR	operational readiness review
PP	product plan
PSLA	project service level agreement
SOMO	Space Operations Management Office
SPS	Small Purchases System
SVF	Science Validation Facility
TDRS	Tracking and Data Relay Satellite
WWW	World Wide Web